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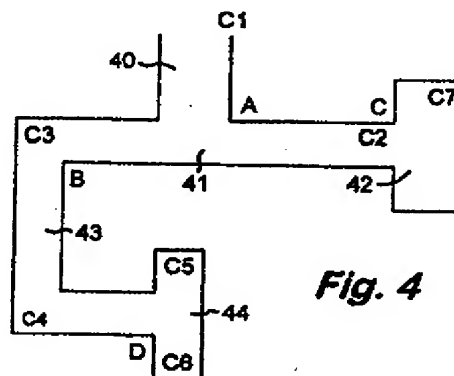United Kingdom

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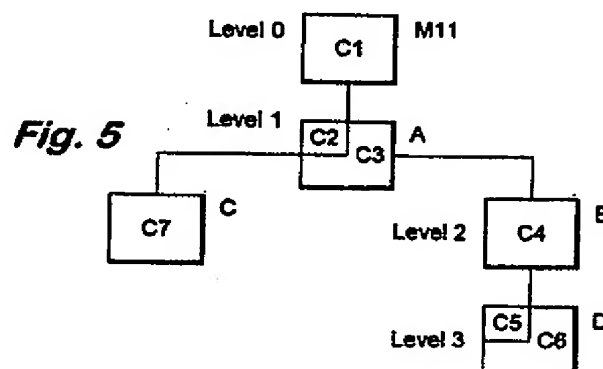GB 2257593 A   EP 0371150 A1   US 5264929 A
US 5194954 A

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UK CL (Edition O) H4F FAAE FAAX FGG FGH FGS
INT CL6 H04N 5/262 5/265 5/268 5/45 7/18
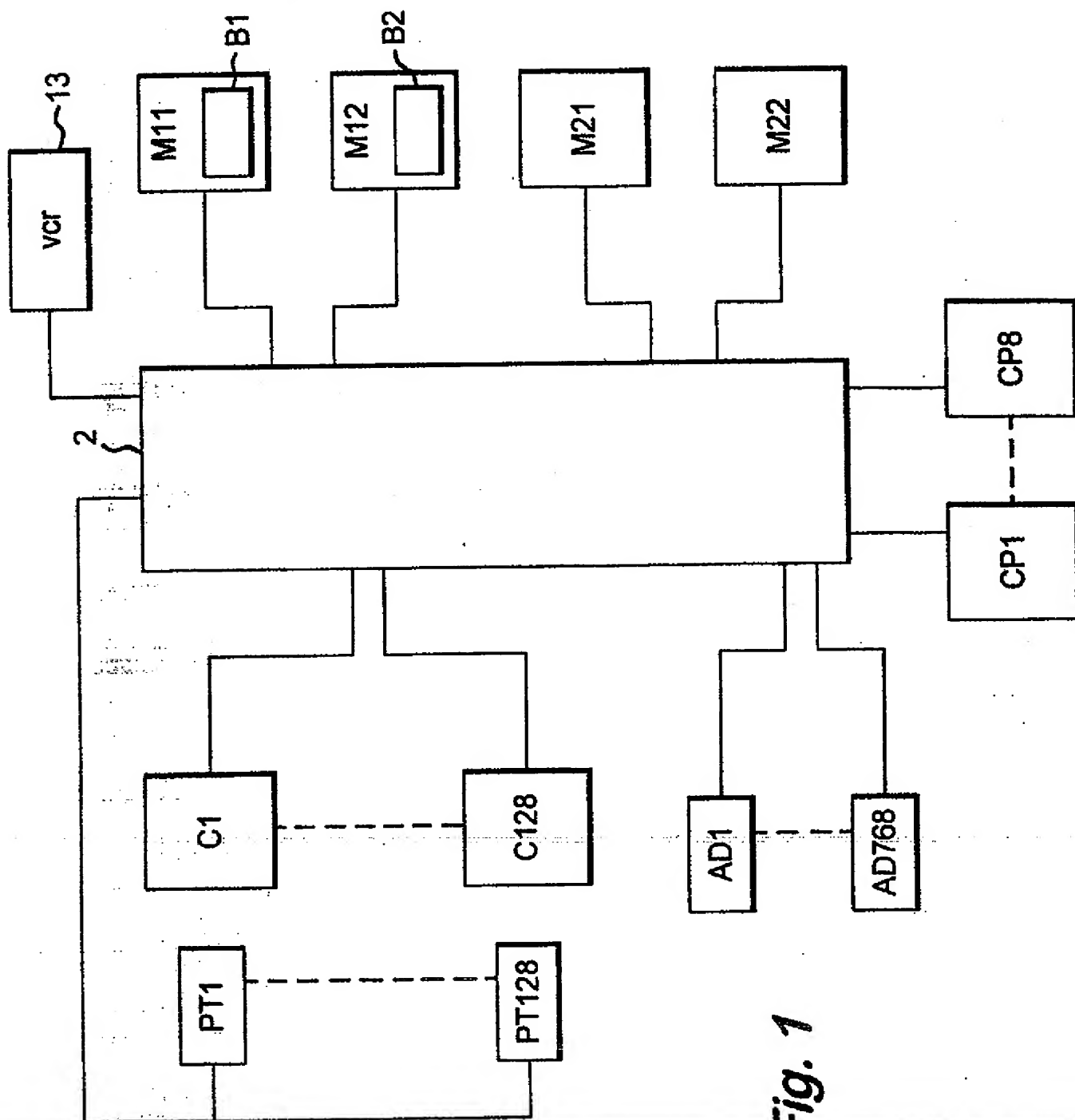Online database: WPI

(54) Abstract Title
Surveillance system

(57) A security system has a plurality of cameras (C1 to C7) presenting different views of an area. The system is programmed to present on a display means (M11) a predetermined hierarchy of views (Figure 5). Each level of the hierarchy comprises one or more sets (A, B, C, D) of views. Each set comprises one or more (e.g. two views (2, 3; 5, 6)) presented simultaneously on the display means (M11). The set of views in one level are linked in a preset manner to views in adjacent levels. The sets of views and the organisation of the hierarchy corresponds to the configuration of the area (Figure 4), thus allowing an operator to follow an intruder merely by requesting the next, or previous, level of views.

Fig. 4

Fig. 5

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

VCR 13

M11 B1

M12 B2

M21

M22

2

CP8

CP1

C1 — C128

AD1 — AD768

PT1 — PT128

Fig. 1

Fig. 2

Fig. 3

MUX — 14

Ri

Ri+7

A/D — 16

H AND V SCALING — 18

FRAME STORE — 20

D/A — 22

VIDEO ENCODE — 24

101,121

10,12

4

C1

40

A   C   C7

C3

C2

B   41   42

43

C5

C4   44

D   C6

Fig. 4

Fig. 5

Level 0   C1   M11

Level 1   C2   C3   A

C7   C

Level 2   C4   B

Level 3   C5   C6   D

A   B   C   D   E
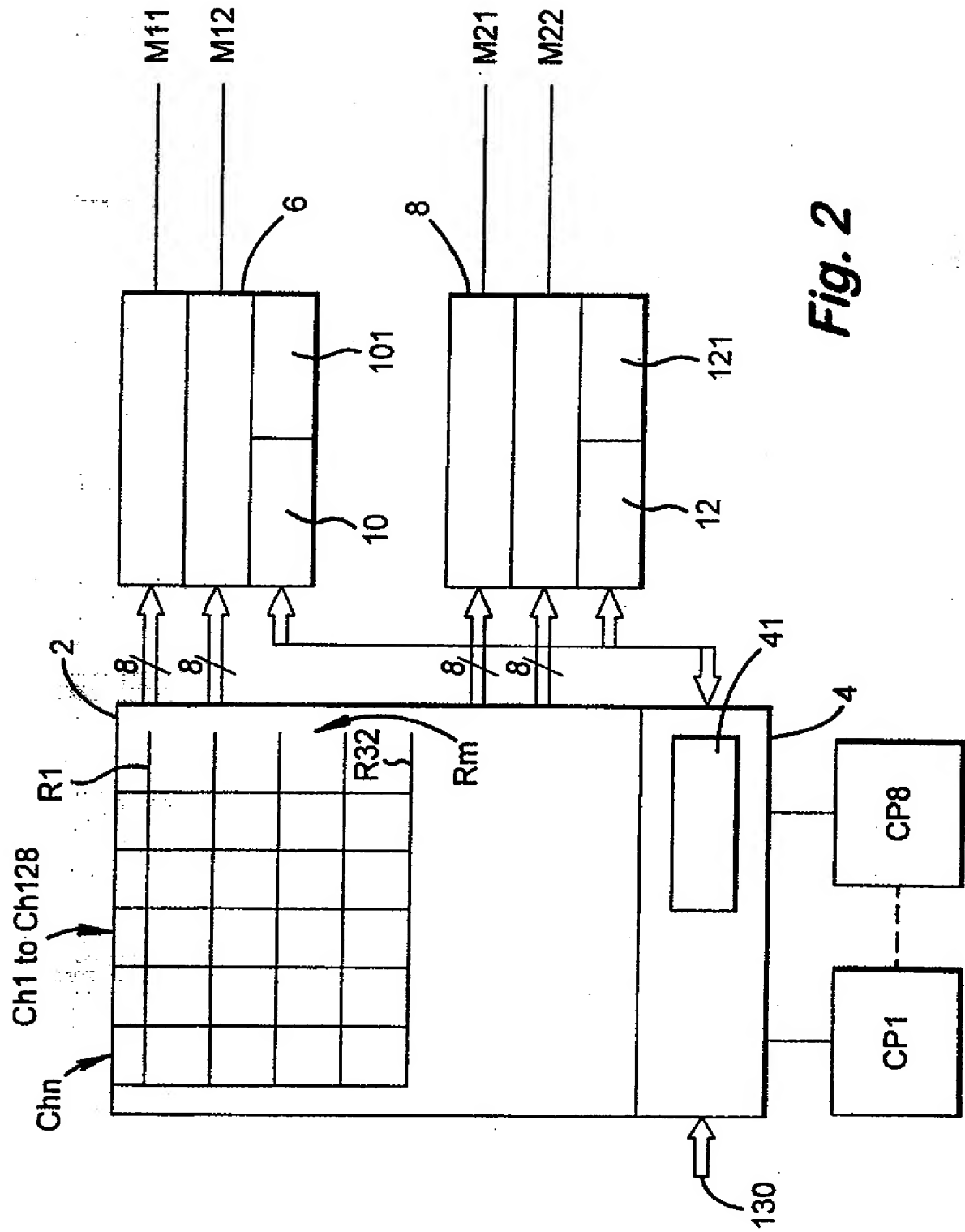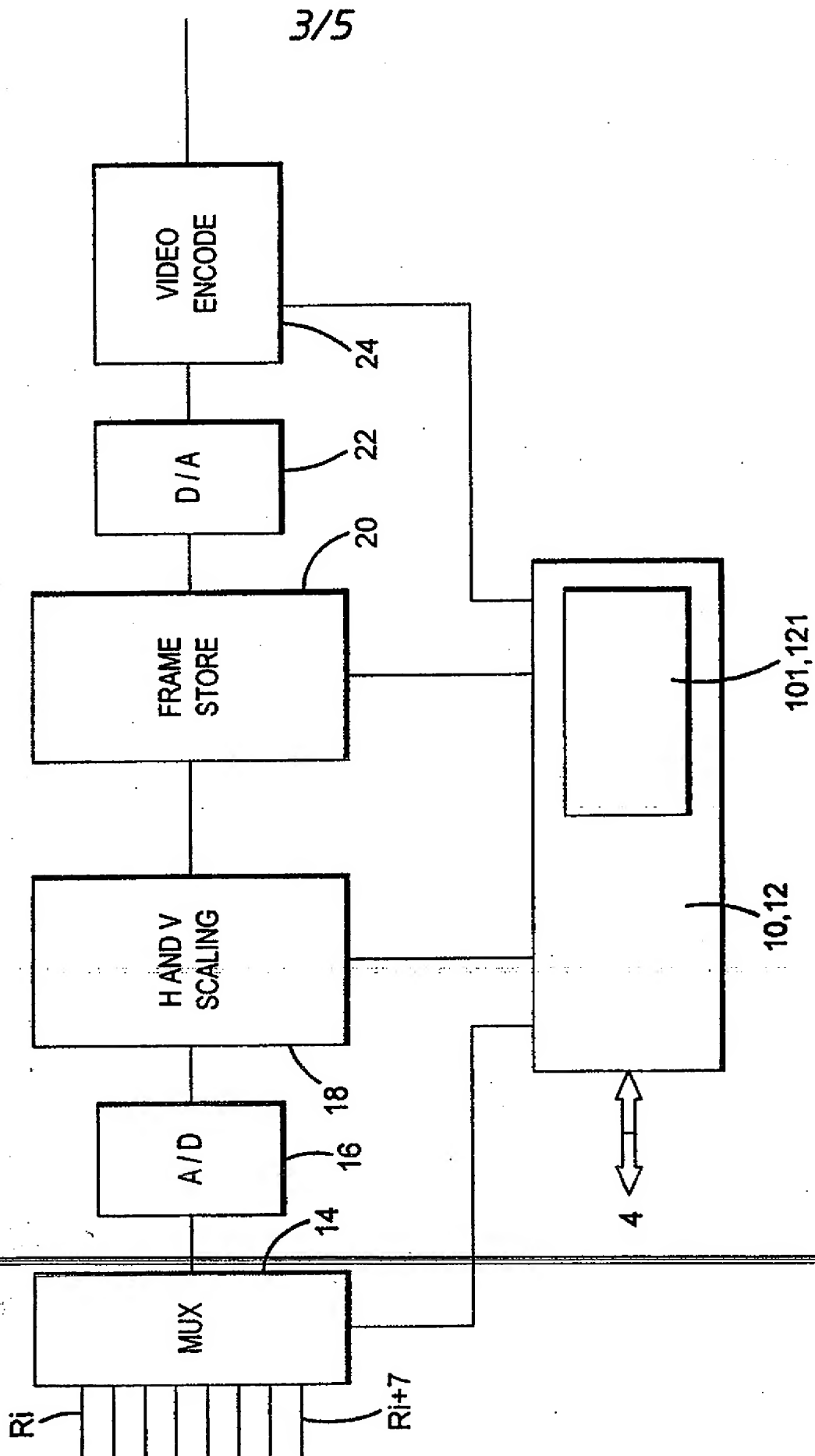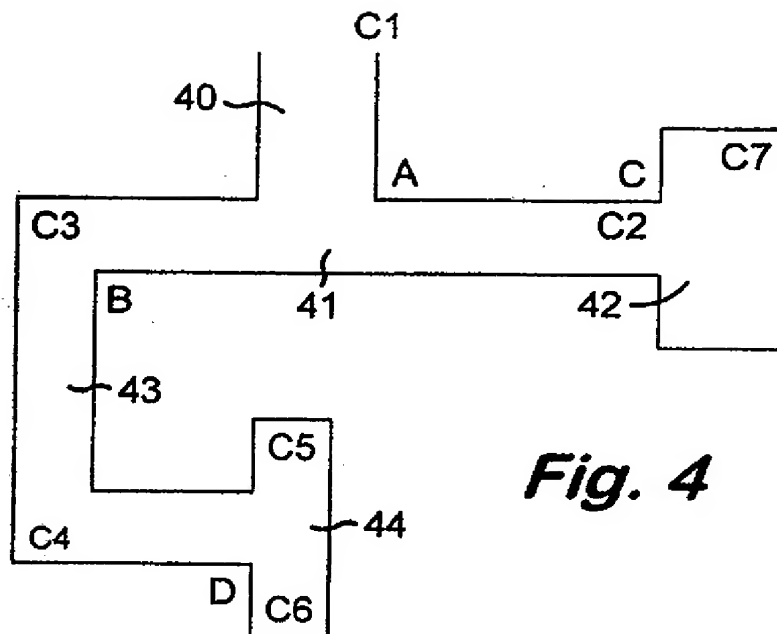
Fig. 7

Fig. 6

SECURITY SYSTEM

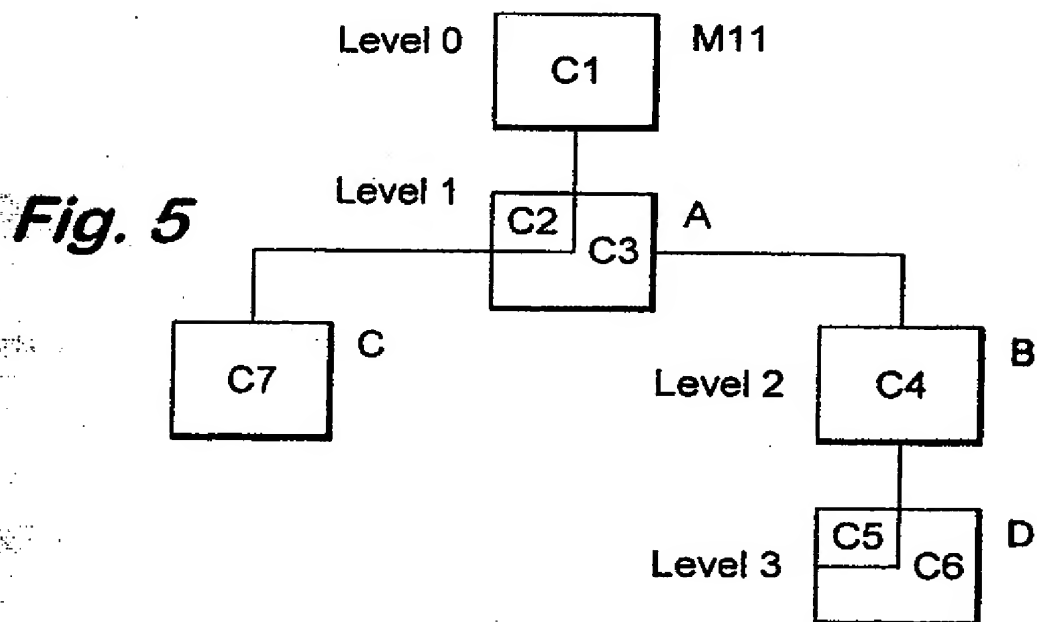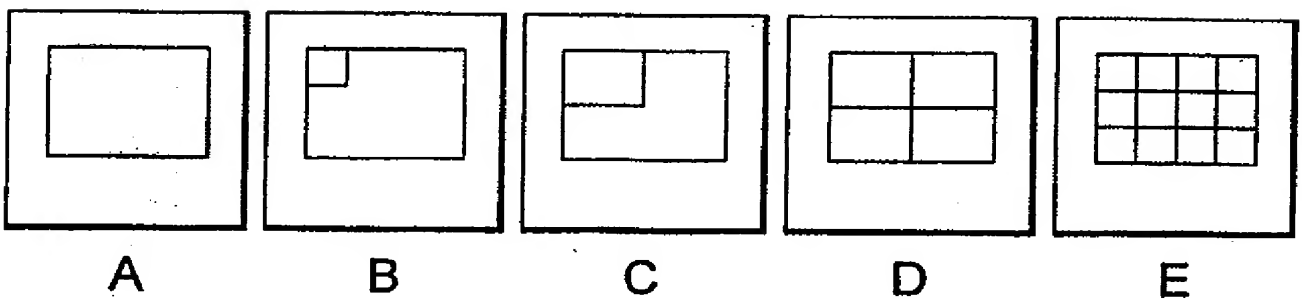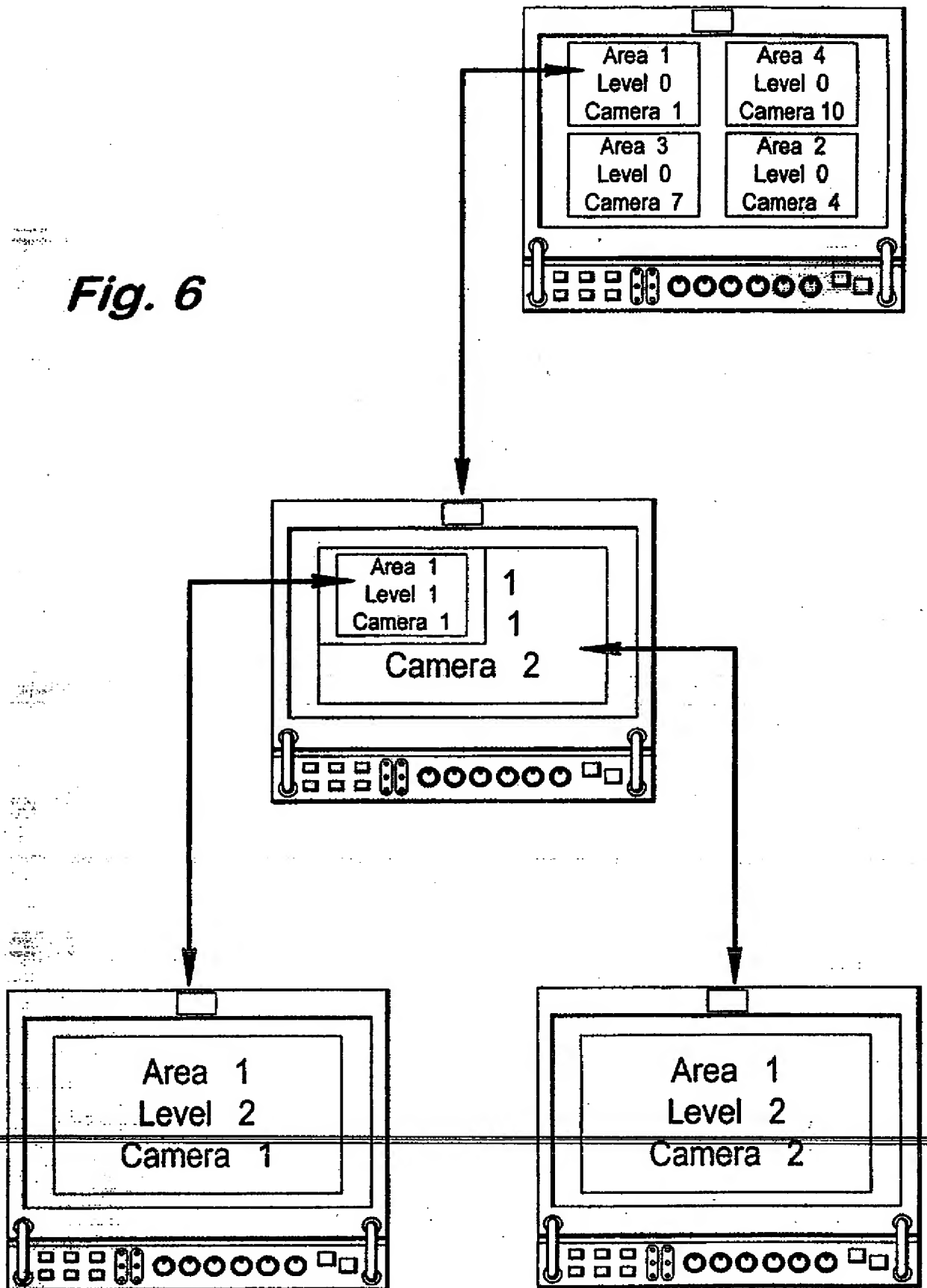The present invention relates to apparatus for use in a security system. Illustrative embodiments of the invention relate to a security system comprising video

5   cameras, the apparatus and monitors for displaying images received by the cameras.

Security CCTV systems are now finding widespread use in monitoring shopping centres, town centres, and commercial and industrial buildings.

The size of these systems may vary from one or two video sources for small retail outlets, petrol stations etc., to large town centre installations which may have

10   greater than a hundred video sources with hundreds of alarm input signals.

In large installations, a great deal of security information is provided to the operators for evaluation. Such large security systems are typically managed by a system controller which can: provide access to a large number of video sources (for example a hundred video screens) and many hundreds of alarm signals; allow control

15   of pan and tilt heads for each camera; provide some control panels (e.g. ten or fewer control panels) for enabling an operator to interact with the system; and present video information on some (e.g. 30 or more) video monitors.

Managing this information to ensure that any incident may be efficiently and effectively identified, dealt with and recorded for evidential purposes can be very

20   operator intensive.

To improve the efficiency of the monitoring process, large security sites are often partitioned or broken down into areas, with one operator assigned responsibility for monitoring each area.

System controllers may provide the facilities to effectively partition an

25   installation into a number, (e.g. eight) of fully functioning sub-systems. Each sub-system has a control interface, a number of video monitors, and access to a sub-set of the video sources and alarm information from the complete installation.

The monitors are watched by operators who use the control panels, e.g. in response to alarms, to control the views presented by the cameras in order to

30   determine the cause of an alarm. Even by assigning one operator to each partition of an installation, an event may trigger many alarms and present the operator with an

overwhelming amount of alarm and video information.

Even with partitioning of a site into areas and the assignment of one operator to each area, an operator may still have many cameras providing many different views of the area for which he is responsible.

5   In the event of an emergency, such as an unauthorised intruder, the operator may be faced with too many views of his area and many choices for changing and/or limiting the views to efficiently follow the intruder.

According to the present invention there is provided apparatus for use in a security system, the security system having a plurality of cameras presenting different
10   views, the apparatus being programmable to present, on a display means, a predetermined hierarchy of predetermined sets of views, each set comprising one or more views presented simultaneously on the display means, the hierarchy having a plurality of levels, each level comprising a said set, a set in one level being linked to a predetermined set in an adjacent level.

15   Thus the invention provides a hierarchy of preset views and/or combinations of views. Because a set in one level is linked to a preset set in the next level, the operator is provided with simple choices when changing from one level in the hierarchy to the next.

In a practical embodiment of the invention, used for surveillance of an area
20   such as a town centre or building, the hierarchy of views and the combinations of views in each level of the hierarchy are related to the layout of the area and routes available in the area between exit points and entrance points.

For a better understanding of the present invention, reference will now be made, by way of example, to the accompanying drawings, in which:

25   Figure 1 is a schematic block diagram of an illustrative security system in which aspects of the present invention are implemented;

Figure 2 is a more detailed block diagram of the system controller of the system of Figure 1;

Figure 3 is a schematic block diagram of a video signal processing channel
30   associated with one monitor of the system of Figures 1 and 2;

Figure 4 is an illustrative schematic diagram of a security area equipped with

a security system embodying the present invention;

Figure 5 illustrates a hierarchy of displays associated with the area shown in Figure 4;

Figure 6 illustrates another hierarchy of displays; and

5   Figure 7 illustrates possible display formats.

Referring to Figure 1 an illustrative security system in accordance with the present invention comprises 128 cameras C1-C128. At least some, and in this example all, of the cameras have pan and tilt heads PT1-PT128. The system also comprises 768 alarm detectors AD1-AD768. One or more video cassette recorders 10   (VCR) 13 may be provided for recording the video signals produced by the cameras. A system controller 2 receives analogue video from the cameras C1-C128, and alarm signals from the alarm detectors AD1-AD768. The controller 2 provides control signals to the pan and tilt heads.

Up to eight control panels CP1 to CP8 are provided. There my be more than 15   8 panels. The control panels CP1-CP8 are used to program the system controller 2 and also are used by operators to control the system in use.

The controller 2 controls in accordance with its programming the display of video from the cameras, and the display of alarms, on four monitors M11, M12, M21, M22.

20   Referring to Figure 2, the system controller 2 comprises a video switcher having 128 analogue video inputs and 32 analogue video outputs. The inputs are shown as (vertical) columns Chn, Ch1 - Ch128 in Figure 2, and the outputs as horizontal rows Rm, R1 - R32. Video switches are controlled by a programmable controller 4, e.g a special purpose data processor or computer including program 25   storage means 41 to connect the columns Chn to the rows Rm in any desired configuration. In addition, the connections can be varied in time.

The 32 outputs R1 to R32 are organised into four groups of eight outputs. One pair of groups or 16 outputs feed analogue video to a first multi-picture processor 6 and the other pair of groups or 16 outputs feed analogue video to a 30   second multi-picture processor 8.

Each multi-picture processor 6, 8, comprises two identical channels both

controlled by a common control processor 10, 12 having a program storage means 101, 121. Each channel processes one group of eight analogue video inputs Ri to Ri+7 e.g. R1 - R8.

The monitors M11 M12 are controlled by the two channels respectively of
5   processor 6 and the monitors M21 and M22 are controlled by the two channels of processor 8.

The control processors 10, 12 are linked to the programmable controller 4 to control the display of information on the monitors in accordance with the programming of the controller 4. Programming of the controller 4 correspondingly
10   programs the control processors 10 and 12.

Referring to Figure 3 each channel of the multipicture processors comprises a multiplexer 14 having eight inputs corresponding to one group of video inputs Ri - Ri+7 and one output. The multiplexer 14 is controlled by the control processor 10, 12 to feed any selectable one of the inputs Ri - Ri+7 to an analogue to digital
15   converter 16. The resulting digital video is fed to a circuit 18 which under the control of the processor 10, 12 scales the video horizontally and vertically to produce an image of desired size (e.g. full screen, 1/4 size, 1/9 size).

The thus scaled image is stored in a frame store 20 under the control of the processor 10, 12. The processor 10, 12 controls the write addresses of the store to
20   position the scaled image in a desired position for display, to allow picture-in-picture displays (PIP displays) or a desired number of pictures to be displayed in an array of pictures e.g. four or eight pictures on one monitor, as will be described hereinbelow.

The image or images stored in the frame store 20 are read-out via a digital to analogue converter 22 to a video encoder 24. The video encoder 24 encodes the
25   video to be compatible with the monitors M11, M12, M21, M22. The video encoder 24 is also controlled by the processor 10, 12 to carry out other functions as will be described hereinbelow.

The system described herein above may operate on monochrome video signals. Alternatively colour video signals may be processed. Although the cameras produce
30   analogue signals, the system could be modified to operate on digital signals produced by the cameras.

A preferred version of the system, as shown in Figure 1 includes the 768 alarm detectors. The programmable controller 4 includes in its program store 41 a look-up table which is programmable to associate the cameras with one or more, e.g. a group of 4, alarm detectors AD.

5   Referring to Figure 4, a building has an entrance 40 viewed by a camera C1. The entrance leads into a corridor 41 which has at one end a room 42 and which leads into another corridor 43 at the other end. The corridor 42 is viewed by two cameras C2 and C3 at the one and the other ends respectively. The room 42 is viewed by a camera C7. The corridor 43 is viewed by a camera C4. The corridor

10   43 leads into a room 44 viewed by two cameras C5 and C6.

Referring to Figures 4 and 5, assume a visitor enters at the entrance 40. The visitor is viewed by camera C1 and a whole screen display from camera C1 is displayed on a monitor M11; that whole screen display is the top level (level 0) of a hierarchy of predetermined displays. When the visitor reaches the corridor 41, he

15   is in view of cameras C2 and C3.

The operator, at a time of his choosing, selects the next level of the hierarchy (level 1), e.g. by actuating a down arrow on a keyboard, and sees on the same monitor M11 predetermined display A which is a PIP display with the camera C2 view inset as a 1/4 size image in the camera C3 view.

20   The visitor can more towards camera C2 or camera C3. If he moves towards camera C2, the operator selects the next level 2 associated with camera C2; i.e. display C comprising the view from camera C7 appears on monitor M11. The level 2 view from camera C7 is linked to the level 1 view from camera 2. If the visitor moves towards camera C3, the operator selects the next level 2 associated with

25   camera C3, i.e. display B comprising the view from camera C4. The display B is linked to the view from camera 3 in level 1.

Where at, e.g. level 2, the operator has 2 or more pictures each of which is linked to the next level 3, the operator selects a desired one of those pictures and then uses the down key to select the next level from that one of the pictures. To select

30   one of several pictures, the pictures are numbered and the operator enters the number of the selected picture. For example, if picture no. 2 is to be selected he enters on

the keyboard of his control panel *2*. Other means of selection may be provided. For example a touch-sensitive display may be used.

As the visitor moves to and past camera C4, the operator selects the next level 3, i.e. display D comprising views from cameras C5 and C6 arranged as a PIP display, which is linked to display D in level 2.

Assume, by way of example, an intruder breaks into the building at room 44 by camera C6, setting off an alarm. The system control associates the resulting alarm signal with cameras C5 and C6 and immediately automatically displays display D on the monitor M11.

By virtue of the linking of views in the levels, the operator can manually traverse through the levels of the hierarchy tracking movement of the intruder, without having to guess which camera will provide the best view.

Preferably a display such as D associated with an alarm is visually emphasised to the operator by, for example a coloured (e.g. red) border. The border may flash for added emphasis. Multiple alarms in different areas may be viewed by the operator very simply. It is possible for the operator to request more alarm views, and the multipicture processor 6, 8 will automatically traverse all hierarchical displays for all zones in sequence showing selected views of each alarm in turn. As alarm conditions become invalid, the operator may "clear" the alarm condition in any zone. As alarm conditions are "cleared", the multipicture processor 6, 8 will automatically display the next valid alarm view. This ensures that only relevant information is displayed to the operator.

By way of explanation, the relationship between "alarm conditions" and "alarm signals" is as follows. When an alarm is raised, for example, by a movement detector detecting movement within an unoccupied area, then an alarm signal is generated and input to the system controller of the security control system. The receipt of the alarm signal generates an alarm condition within the security control system, which causes the image associated with the alarm condition to be displayed. When an operator has noted any particular alarm condition, he/she can clear that alarm condition, which will cause the image associated with that alarm condition to be removed from the display means. This action does not in itself remove the alarm

signal, the alarm signal only being removed by sending a reset signal to the device generating that alarm signal. However, the alarm condition associated with that alarm signal will not be re-triggered until that alarm signal has been reset. In preferred embodiments, a permanent record of all alarm signals generated is kept, even after

5   an operator has cleared particular alarm conditions.

An alarm condition can be used to trigger a VCR 13 to record.

Thus, a predetermined hierarchy of predetermined displays arranged in successive levels are shown on one monitor M11, views in one level being linked in a preset manner with views in adjacent levels. The displays in the hierarchy and the

10   sequence of the displays are chosen to correspond to the layout of the building, thus reducing the burden on the operator and reducing the likelihood that important information is missed.

The example of Figure 4 involves seven cameras linked to one monitor M11, covering one area having up to eight (in this case, seven) monitored zones. The

15   hierarchy of displays A to D and the manner in which they are interlinked (as illustrated in Figure 5) are stored in the control processor 10, 101; 12, 121 of the multipicture processor 6, 8. In the example of Figures 4 and 5 there is only one hierarchy.

However, there may be many different hierarchies. Referring to Figure 6, at

20   level 0 a plurality of areas (e.g. four areas 1 to 4) may be monitored and a separate and different hierarchy may be associated with each area. Figure 6 shows a hierarchy associated with area 1 involving only two cameras.

Each level in the hierarchy may use any of the illustrative display formats A to E shown in Figure 7, where:

25   A   Full screen single image

B   Picture-in-picture display (PIP) 1/9 image inset

C   PIP 1/4 size inset

D   Array of four 1/4 size images

E   Array of eight 1/9 size images

30   Any camera view may be placed in any position within the various formats.

As shown in Figure 6, the area identification, camera identification and/or

hierarchy level may be displayed optionally together with the date and/or time.

In summary of the above described embodiments a security system has a plurality of cameras (C1 to C7) presenting different views of an area. The system is programmed to present on a display means (M11) a predetermined hierarchy of
5 views (Figure 5). Each level of the hierarchy comprises one or more sets (A, B, C, D) of views. Each set comprises one or more views (e.g. two views (2, 3; 5, 6)) presented simultaneously on the display means (M11). The sets of views in one level are linked in a preset manner to sets of views in adjacent levels. The sets of views and the organisation of the hierarchy corresponds to the configuration of the area
10 (Figure 4).

The top level 0 of the hierarchy may be used to preset an overview of an area subject to surveillance by the security system. The operator would manually traverse the levels when an event arises which requires traversal. The levels may be arranged to give progressively more detail, or as discussed above, to track routes through an
15 area.

CLAIMS

1.   Apparatus for use in a security system, the security system having a plurality
of cameras presenting different views, the apparatus being programmable to present,
on a display means, a predetermined hierarchy of predetermined sets of views, each
set comprising one or more views presented simultaneously on the display means, the
hierarchy having a plurality of levels, each level comprising a said set, a set in one
level of the hierarchy being linked to a predetermined set in an adjacent level.

2.   Apparatus according to claim 1 comprising:
        video switch means for receiving video signals from the plurality of cameras;
        a video signal processor, to which the switching means couples selected sets
of the video signals for display of the sets of views reproduced thereby on a display
device; and
        programmable control means for controlling the switching means and the video
signal processor to present the said predetermined hierarchy of predetermined sets of
views on the display device.

3.   Apparatus according to claim 2, further comprising means for receiving alarm
signals from alarm detecting means and for linking the alarm signals with video
signals, the control means being responsive to an alarm signal to cause the display
device to display the one of the said predetermined sets including the video signal
linked to that alarm signal.

4.   Apparatus according to claim 3, comprising operator controlled means for
clearing the alarm indications, the said control means being responsive to clearing of
an alarm indication to automatically display another one of the said predetermined sets
including a video signal linked to another alarm signal.

5.   Apparatus according to any preceding claim, comprising operator controlled
means for selecting from a said set at a level, the linked set at an adjacent level.

6.   Apparatus according to claim 1, 2, 3 or 4, programmed to present the said predetermined hierarchy.

7.   Apparatus according to claim 1 for use in a security system and substantially hereinbefore described with reference to the accompanying drawings.

8.   A security system comprising apparatus according to any preceding claim, a plurality of cameras, and display means.

The Patent Office

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Application No: GB 9719797.4	**Examiner:** Sue Willcox
Claims searched: 1	**Date of search:** 17 November 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H4F (FAAE, FAAX, FGG, FGH, FGS)

Int Cl (Ed.6): H04N (5/262, 5/265, 5/268, 5/45, 7/18)

Other: Online database: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2257593 A	SAMSUNG ELCTRONICS CO., LTD - see page 5, line 27 to page 6, line 14	1
X	EP 0371150 A1	OLIVER - see column 2, lines 19 - 33	1 - 3 at least
X	US 5264929 A	YAMAGUCHI - see particularly column 4, lines 46 - 60	1 - 3 at least
X	US 5194954 A	DUFFIELD - see particularly column 5, lines 10 - 18 and 40 - 61	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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